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PAPER

IN

CHEMISTRY.

CHEMISTRY.

The Society this year received the following Letters from the Rev. WILLIAM MASON, of Aſton near Rotheram, giving an account of a method of generating Yeaſt. To aſcertain this curious fact, experiments were made, as hereafter mentioned: which fully ſucceeding, Thanks were given to Mr. MASON for the communication, and a bounty of Twenty Pounds to his ſervant JOSEPH SENYOR, to whom the diſcovery was firſt owing.

SIR,

LAST ſpring I requeſted a friend to inquire of you ſome particulars concerning the premium which the Society had offered on the production of Yeaſt, of which you obligingly gave him full information.

As I found November was the month in which the matter was to be decided, I deferred troubling you any more till I had cauſed an experiment to be repeatedly tried; which a domeſtic of mine, who brews for me, had at that time firſt made.

I had juſt before, with his aſſiſtance, impregnated wort with fixed air, or rather a decoction of malt in water, according to Dr. Henry's ingenious method, mentioned in the Memoirs of the Philoſophical Society of Mancheſter, and by the Yeaſt thereby obtained produced good bread. This led him, unknown to me, to try whether the experiment would not ſucceed full as well without fixed air; which he found it did. He accordingly brought me a ſmall veſſel with a full head of Yeaſt upon it, aſſuring me with ſome degree of exultation, that neither oil of vitriol with chalk, nor any portion of old Yeaſt, had been employed on the occaſion. This greatly ſurpriſed me; and I then deſired he would proceed with the experiment in his own way, and endeavour to increaſe the quantity already made, by what additional decoction of malt and water he might think proper; inſiſting only that nothing but malt, water, and heat, ſhould be employed for the purpoſe. He did ſo, and in a few days increaſed the original quantity till it became ſufficient to work a hogſhead of ſmall-beer, which produced ten pounds weight of perfect Yeaſt; and this, being ſoon after put on a vat for a hogſhead of ale, was found to be augmented to forty-two pounds.

The diſcovery therefore is ſimply this: "that Yeaſt is not (as has, I believe, been "hitherto thought) ſome peculiar and "unknown ſubſtance, neceſſary to be added "to wort in order to put it into a fermenting "ſtate; but that malt boiled in water will "generate it (as the chemiſts ſay) *per ſe*, "if the following circumſtances be attended "to.

"1ſt, That the proceſs be begun with a "ſmall quantity of the decoction.

“ 2dly, That it be kept in an equal degree
“ of heat. And,

“ 3dly, That, when the fermentation is
“ begun, it ſhould be aſſiſted and augmented
“ with freſh decoctions of the ſame liquor.”

The proportions and method which my ſervant has found generally to ſucceed, I will now give you, as taken from his own words, in the form of a recipe.

Procure three earthen or wooden veſſels of different ſizes and apertures, one capable of holding two quarts, the other three or four, and the third five or ſix: boil a quarter of a peck of malt for about eight or ten minutes in three pints of water; and when a quart is poured off from the grains, let it ſtand in a cool place, till not quite cold, but retaining that degree of heat which the brewers uſually find to be proper when they begin to work their liquor. Then remove the veſſel into ſome warm ſituation near a fire, where the thermometer ſtands between 70 and 80 degrees (Fahrenheit), and there let it remain till the fermentation begins, which will be plainly perceived within thirty hours; add then two quarts more of a like decoction of malt, when cool, as the firſt was; and mix the whole in the larger-ſized veſſel, and ſtir it well in, which muſt be repeated in the uſual way, as it riſes in a common vat: then add a ſtill greater quantity of the ſame decoction, to be worked in the largeſt veſſel, which will produce Yeaſt enough for a brewing of forty gallons.

As I cannot conveniently ſend my ſervant to town on this occaſion to produce the Yeaſt himſelf, and have alſo ſome doubt whether the ſimplicity of the proceſs will not make it diſregarded, I have thought it beſt to communicate the diſcovery previouſly to you, who, as my friend told me, appeared to be intereſted in its ſucceſs; hoping you may be induced to try ſo eaſy an experiment, and to acquaint me with the reſult of it, before you commmunicate it to the Society. With my brewer it has never failed, except when the failure was to be accounted for from an inequality of temperature of the air, where the experiments were made: it ſeems therefore to me, that in the hands of a good practical brewer, accommodated with a place where his little vat will ſtand in a conſtant degree of proper heat, it will generally ſucceed, eſpecially in the brewing ſeaſons.

I am, Sir,
Your obliged humble ſervant,
William Mason.

York,
Oct. 14*th*, 1789.

Mr. More.

P. S. It may be proper to add that my ſervant is of opinion, that a proper quantity of hops boiled in the liquor makes the fermentation proceed better; but as it may, and has actually ſucceeded without ſuch addition, I would willingly wiſh them to be omitted, to prevent the bread baked with it from taſting bitter. Experience only can decide this; and farther experience is ſtill wanted, to make a perfect recipe for the operation.

SIR,

I MEANT my former letter as a private one to you, merely to induce you to make the ſimple experiment therein mentioned; however, as you think it contains a diſcovery of ſufficient conſequence to be communicated to the Society, I have no objection to your doing it. They will have before them a plain fact, which may be expreſſed in one ſhort definition; that "Yeaſt, uſed for the purpoſes of brewing "malt liquor, and in making bread, is a "viſcid frothy ſubſtance, which ariſes on "the ſurface of a ſimple decoction of malt "in water, when in a ſtate of fermentation;

" and which ſubſtance, after it has been " ſo generated, may, by additional quan" tities of the ſame liquor gradually ſup" plied, be increaſed *ad infinitum.*" This definition, duly attended to, will put the Committee on their guard in adjudging the premium to any perſon who, by adding any known or unknown article to wort, offers it as a ſubſtitute for old Yeaſt taken from a former brewing, becauſe they will be taught that new original Yeaſt may be obtained from wort itſelf without any ſuch ſubſtitute.

With reſpect to the doubt you expreſſed in your obliging anſwer to my laſt, I can with truth aſſure, that in all the primary decoctions made hitherto for the purpoſe, coarſe earthern and *glazed* pots have been uſed, till a quantity of Yeaſt ſufficient to work a brewing of beer was produced: after which, the proceſs was carried on in a large wooden vat; and therefore, when I uſed in my laſt the epithet *wooden* as well as earthern, it was merely becauſe I thought the former kind of veſſels leſs liable to accidents.

Certain it is, that in two experiments lately made here in York, one by myſelf, the other by my friend Dr. Burgh, a gentleman much more converſant in chemical matters than myſelf, new earthern veſſels bought out of the ſhops were employed.

He produced excellent bread from the Yeaſt which his decoction had generated, without any addition of hops: a ſmall quantity of hops were boiled in mine; which, without much affecting the taſte of the bread baked with it, left about four gallons of table beer, now in a ſmall caſk; which, though not fine, from having been brewed little more than a fortnight, is greatly preferable to the wretched bitter beverage ſold by our common brewers, from whoſe vats a Yeaſt is produced, equally unpalatable for the purpoſe of baking, and perhaps equally unwholſome both for baking and brewing.

I am much obliged to you for the attention which you promiſe to pay to the experiment; but I cannot help wiſhing that you had at your elbow one of our old houſewives in one of our obſcure Yorkſhire dales, uſed, as they are, to very ſmall brewings, who, after two or three little blunders, would ſoon bring it to a certainty.

I am, Sir,

Your much-obliged, and

very obedient humble ſervant,

William Mason.

York,
Oct. 24*th*, 1789.

Mr. More.

Dear Sir,

I should have anſwered your obliging letter, which informed me that the experiment had ſucceeded before the Committee, had I not waited to give you an account of another which I was then making, in hopes of ſimplifying the proceſs ſtill farther.

This was by ſubſtituting a ſimple *infuſion* of malt inſtead of a *decoction*, and draining the liquor through a ſieve, inſtead of leaking it off gradually. Yeaſt was apparently generated by this means, and by the ſecond additional infuſion conſiderably increaſed; but when beat in, did not riſe again. I conſider this experiment therefore as abortive; yet I chooſe to mention it to you, as, by knowing what methods fail, as well as thoſe which ſucceed, proceſſes of this kind can only be brought to a certainty.

I have much ſatisfaction in learning that the Gentlemen of the Committee (to whom I beg my beſt compliments) have thought my ſervant deſerving of the reward you mention. His name is Joſeph Senyor, of

Aſton, in the Weſt Riding of Yorkſhire. I hope however, before the time when the premiums are given, we may be able, by a repetition of experiments, to bring the matter to ſo great a degree of certainty, as to eſtabliſh a rule or recipe for generating Yeaſt in the beſt manner: for hitherto we only know how it may it be done, not how it may beſt be done; to promote which, I flatter myſelf, you, Sir, will contribute your aſſiſtance, and continue the correſpondence which you have ſo obligingly carried on with me on the ſubject.

I am, Sir, with great eſteem,

Your moſt obedient ſervant,

William Mason.

Nuncham,
Dec. 16*th*, 1789.

Mr. More.

Dear Sir,

According to my promiſe, I write to inform you of the reſult of ſome more experiments which have been made here, under my direction, relative to Yeaſt; and the rather, becauſe they were made by means of a very ſimple apparatus, which I think will be found very convenient on ſhip-board, and alſo in cottages, &c. It is merely a wooden box, of about twelve or fourteen inches ſquare, open on one ſide, in which a veſſel containing the wort is placed; and then the box is ſet with the open ſide cloſe to a wall, heated by a fire on the other ſide, when the thermometer indicates the wall to be about 80°: ſo that I imagine the back of a chimney in a ſhip, or behind an oven or kitchen-fire in a cottage, would be found very convenient for the proceſs; as the veſſel might be there ſurrounded with a ſmall atmoſphere of air, ſufficiently warm at the firſt, and capable of being continued at the ſame equable temperature for a ſufficient time.

A box of this kind, in which the following experiments were made, was placed on a dreſſer in my kitchen, more than eighteen feet from the kitchen-fire, but againſt a thin wall, which divides the kitchen from the ſervants hall, juſt behind the fire-place of that room; and the open ſide of the box turned to the heated wall, the veſſels themſelves uncovered. If you recollect the trouble you ſo obligingly took in heating your office, you will think this method, ſince diſcovered, of performing the ſame experiment, of conſiderable utility.

Experiment 1ſt.—Three veſſels were ſet at the ſame time in the warm box, containing a quart of liquor each, and of equal ſtrength with reſpect to malt: one was a decoction without hops, another with hops, the other a ſimple infuſion of malt: in about twenty-four hours the hopped decoction produced a fine head of Yeaſt; the other decoction fermented as well, but was twenty-four hours later; the ſimple infuſion was near thirty-ſix hours later, and the Yeaſt appeared dark and ill-coloured, ſo that my houſekeeper thought it ſpoiled; but this bad appearance was merely owing to its not having been boiled and cleared, for it made very light breakfaſt rolls.

This experiment, you will perceive, was made to try whether hops (as my ſervant imagined) were neceſſary; and it certainly proves that they accelerate the fermentation; but it proves alſo, that neither hops nor boiling are eſſential to the proceſs.

Experiment 2d.—Four veſſels from a common brewing of ale were placed in a box of longer dimenſions; one contained two quarts; a ſecond, one; a third, a pint; a fourth, half a pint: they all ſhewed ſigns of fermentation at the ſame time, viz. in about twenty-four hours; but that in the mug or pot holding a pint appeared the ſtrongeſt, which my ſervant thought was owing to the ſmaller diameter of the veſſel, which was ſmaller in proportion to the half-pint; but as it ſtood more centrally to the heat of the fire behind, I am perſuaded the exceſs of fermentation proceeded from that cauſe. This proves that the quantity you begin the proceſs with is not very material: though two quarts ſeem to be moſt convenient for the purpoſe of baking.

Experiment 3d was inſtituted merely to find whether an addition of ſugar would accelerate the fermentation; for which purpoſe, two quarts of hopped liquor were tried in ſeparate veſſels, a quart in each: and the reſult was, that the decoction, in which two large ſpoonfuls of coarſe ſugar were ſtirred in, did not ferment in the leaſt, though continued in the warm box five days and nights; the other fermented in about thirty-ſix hours. The reaſon of this later fermentation than of that in the former experiments, was, that the liquor uſed was from a brewing of ſmall-beer. Hence we may conclude, that a decoction of the ſtrength of ale, if not of ſtrong beer, is the beſt to begin with.

I cannot myſelf think of any other experiments that may tend to elucidate the matter further; but if you pleaſe to propoſe any, I can with much eaſe make them, eſpecially at this brewing ſeaſon (though theſe I have already made are of a month's ſtanding), and ſhall with great pleaſure ſend you the reſult. Believe me to be, with true eſteem,

Dear SIR,

Your faithful and obedient ſervant,

WILLIAM MASON.

Aſton, near Rotheram,
March 20th, 1790.

ACCOUNT

ACCOUNT *of Experiments on the* GENERATION *of* YEAST, *made under the Inſpection of the Committee of Chemiſtry, in the month of November,* 1789.

FOUR quarts of ground malt were put into a new ſtone ware veſſel, and maſhed with about an equal quantity of hot water in the uſual manner for brewing. When the maſh had ſtood about an hour, the wort was drawn off, and three quarts of boiling water poured on the grains: when this had ſtood a due time, the liquor was ſuffered to run off, and the whole liquor boiled half an hour; being then ſet to cool, was poured clear from the ſediment, and then put in a room where the heat was regularly kept up to ſummer heat, or near 80° of Fahrenheit's thermometer. It ſtood in this degree of heat till ſome ſigns of fermentation appeared on the ſurface; which came on in about three days.

Another brewing was then made as above deſcribed; and, when of a due heat, ſtirred into the former liquor. In about twenty-four hours ſome Yeaſt appeared, and another brewing was then made; and, when of a due heat, mixed with the two former ones, and well beat in, the heat being ſtill kept up to the degree above mentioned: in about two days more, five ounces of excellent Yeaſt were collected from the ſurface of the liquor.

Some of this Yeaſt being mixed with a due proportion of flour, water, and ſalt, anſwered all the purpoſes intended for bread; and might certainly have been equally well applied to brewing, in the common method. In fine, being pure and good Yeaſt, it will anſwer all the intentions of that uſeful article.